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## PATENT SPECIFICATION

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## (54) METHOD AND APPARATUS FOR CRIMPING YARN

5 (71) We, AKZO N.V., a Company organised and existing under the Kingdom of the Netherlands, of IJssellaan 82, Arnhem, the Netherlands, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:-

10 The invention relates to a method for manufacturing crimped yarn and an apparatus therefor. A known method for manufacturing crimped yarn comprises the successive steps of feeding the yarn to a tubular treating chamber with the aid of a fluid under pressure, such as air or steam, to form a wad extending in the direction of the length of the chamber, at least part of the fluid escaping sideways from the chamber, and discharging the treated yarn from the chamber. In this method an external control signal may regulate a process parameter via a transmission means in response to the position of the wad.

15 A method of this type is described in British Patent No. 1,422,949 in which the position of the yarn wad at the discharge end is scanned and the deviations of the measured position from a predetermined position are used to control the temperature of the fed yarn. Although this method may make it possible to obtain reasonable results under some conditions, it has the disadvantage that the deviations or irregularities in the process are detected at a relatively late stage.

20 35 We have now developed a method of the type indicated above which does not have this drawback.

Accordingly, the present invention provides a method for manufacturing crimped yarn which method comprises the successive steps of feeding the yarn to a tubular treating chamber with the aid of a fluid under pressure to form a wad extending in the direction of the length of the chamber, at least part of the fluid escaping sideways

from the chamber, regulating a process parameter via a transmission means in response to an external control signal indicative of the starting point from which the yarn wad extends into the treating chamber and discharging the treated yarn from the chamber.

The signal produced is indicative of the point from which the yarn wad extends into the treating chamber, and the control is so effected that the starting point of the wad is kept within a predetermined range. In this way any changes in the formation of the yarn wad can immediately be observed and corrected, which contributes to maintaining a constant quality. Such prompt action also enables higher yarn speeds to be realised, there being a great need for such higher speeds, the use of more integrated processes, i.e. processes in which the crimping, drawing and/or spinning are carried out in a single continuous operation.

Preferably, the predetermined range is a distance of not more than 5 mm, and more preferably about 2.5 mm, on either side of the preset desired starting point of the yarn wad.

In order that the yarn treating chamber may be satisfactorily filled the preset desired starting point of the wad is generally at a distance from the entrance of the yarn treating chamber corresponding to not more than one-third of the length of the yarn treating chamber provided with lateral outlets for the fluid under pressure.

In a preferred embodiment of the method of the invention, the control signal regulates via a transmission means the pressure of an air flow to the yarn wad, more particularly cooling air and the resulting variations in the cooling air pressure are of the order of 1 bar or not more than 50% of a preset value.

In another embodiment of the invention the control signal regulates via a transmission means the pressure, the amount, the speed

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and/or the temperature of the fluid fed under pressure to the treating chamber. It is also possible for the control signal to regulate the temperature of the fed yarn via a transmission means. Good results are obtained by a method in which a pneumatic control signal is used which may be derived from one or more control air streams flowing at right angles to the yarn treating chamber, these streams being partly stopped by the yarn wad. Advantageously, the control air streams flow at right angles to the yarn treating chamber over a large part of the length thereof. In this way the yarn treating chamber can be scanned for the presence of the yarn wad practically throughout its length. In accordance with the invention use may be made of a mechanical, electric or visual control signal, or a combination thereof, such as a photo-electric, electro-mechanical or electro-magnetic signal.

The invention also provides an apparatus for carrying out the method hereinbefore described which apparatus comprises a yarn feeding channel coupled to a yarn supply and a conduit for supplying fluid under pressure, the yarn feeding channel ending in a tubular yarn treating chamber provided with lateral openings, and a sensing device positioned near the entrance of the yarn treating chamber which device, in use, emits a signal which serves to control a process parameter via a transmission means.

Advantageously, the sensing device is provided in longitudinal direction of the yarn treating chamber with a number of successive outflow openings for control air.

The wall of the yarn treating chamber may be substantially formed by a number of circumferentially spaced fins, at least one of said fins being provided with a cavity adapted to connect to a supply of control air and at its edge facing the yarn treating chamber with a number of outflow openings. The sensing device is advantageously connected via a transmission means to means for regulating the pressure of the cooling air to be fed to the yarn treating chamber. The sensing device may also be connected via a transmission means to a system for regulating the pressure, the amount, the speed and/or the temperature of the fluid under pressure which serves to feed the yarn to the treating chamber. The sensing device may, if desired, also be adapted to control the temperature of the supplied yarn. According to the invention the sensing device may be constructed to produce a mechanical, an electrical or a visual control signal or a combination thereof.

The invention will be further described with reference to the accompanying schematic drawings in which:

Figure 1 is a longitudinal section of a particular embodiment of the crimping apparatus

of the invention;

Figure 2 is a longitudinal section of a different embodiment of the crimping apparatus of the invention;

Figure 3 is a cross-sectional view along the line III-III of Figure 2; and

Figure 4 illustrates still another embodiment of the invention.

Referring to Figure 1 of the drawings, the yarn 1 passes through an inlet 2 into the channel 3 to which a fluid under pressure, such as air or steam, is fed in the direction indicated by the arrow 4. The yarn arrives via the relatively narrow channel 3 in the tubular yarn treating chamber 5 whose wall is formed by a number of circumferentially spaced fins 6. The fluid under pressure can escape between the fins into the annular chamber 8 in the direction indicated by the arrows 7. Cooling air at room temperature is fed through conduit 10 into the discharge channel 9 in the direction indicated by the arrow 11. The cooling air flows partly into outlet opening 12 and partly into the yarn treating chamber 5, from which the cooling air together with the fluid fed thereto under pressure is drawn between the fins 6 into the annular chamber 8 with the aid of a suction line 13.

The cooling air being capable of flowing in two directions relative to the transport direction of the yarn forms an important aspect of the method of the invention.

In operation the expanding fluid escaping sideways between the fins 6 causes the formation in the treating chamber 5 of a yarn wad 14. A sensing device 15 schematically indicated with an arrow point is located near the entrance to chamber 5. The sensing device may be constructed in various ways. The sensing device 15 detects the starting point of the wad of yarn 14 in the treating chamber 5. When the sensing device 15 senses that the starting point of the wad is displaced from entrance 16 of the treating chamber (viewed in the direction of travel of the yarn), a signal is passed via an appropriate transmission means and line to the cooling air feed and the pressure of the cooling air fed through conduit 10 is increased. As a result, the beginning of the wad of yarn will again approach its preset position at the entrance to treating chamber 5 and the sensing device will then, via the transmission means, pass a signal to reduce the pressure of the cooling air.

Figures 2 and 3 show a modified embodiment of the apparatus in which like parts are referred to by like numerals. This embodiment differs from the embodiment illustrated in Figure 1 mainly in that it is provided with a measuring fin 18 having a cavity 19 throughout its length. This cavity connects with a conduit 20 for the supply of control air under pressure. The measuring fin 18 is

provided along its length with a number of flow passages 21 for control air which terminate at one side in cavity 19 and at the other side in the yarn treating chamber 5. The passages 21 have a diameter of 0.5 mm and are spaced at intervals of 1.5 mm. In operation there is a constant flow of control air from passages 21 into chamber 5. A number of flow passages will be closed by yarn wad 14, depending on the position of the yarn wad 14 in the chamber 5. As a result, pressure variations in cavity 19 will occur which are dependent on the point at which the wad of yarn begins. These variations in pressure are transformed into signals which are passed through an appropriate means 22 to the supply 17 of cooling air, so that a similar regulation of the supply takes place as described with respect to Figure 1.

Figure 4 shows a somewhat different embodiment, like parts being referred to by like numerals. In this embodiment the first half 23 of the axial length of the yarn treating chamber is provided with a large number of control air passages for measuring the position of the beginning of the wad and thereby serving to regulate the pressure of the cooling air. At the other end of the yarn treating chamber 5 a similar group of control air passages 24 is located which serve to check upon the presence of the wad.

Various modifications may be made within the scope of the present invention. For example, instead of being carried out pneumatically the measurement of the position of the wad in the yarn treating chamber may be effected in various other ways. Furthermore, a process parameter other than the cooling air pressure may be controlled, such as the pressure or the temperature of the fluid under pressure which aids the supply of yarn to the treating chamber. Although the yarn is preferably crimped and supplied by means of hot air, it is in principle also possible to use steam. The treating chamber 5 may be constructed in different ways and may, for example, be wide or narrow instead of being cylindrical. Various forms for the perforations of the wall of the yarn treating chamber are possible. For example, the width of the gaps between the fins 6 may gradually widen or narrow.

The tubular yarn treating chamber may be of any suitable cross-section e.g. circular, rectangular or square. The method and apparatus according to the invention may advantageously be employed in an integrated process such as spindrawtexturizing, in which the draw roll often has a double function. The yarn is subjected to heat treatment for the purpose of obtaining a qualitatively satisfactory starting yarn for the texturizing process. Moreover, the yarn on this roll will be effectively plasticized so that it reaches a satisfactory crimp level in the texturizing process. The draw roll temperature required to obtain an optimum starting yarn may, however, be too high also to obtain an optimally crimped yarn. In a variant embodiment of the integrated process the two functions of the draw roll may be carried out separately, with the yarn being drawn on one roll having a high temperature and cooled while under tension on a second roll to a temperature which permits optimum crimping.

**WHAT WE CLAIM IS:-**

1. A method for manufacturing crimped yarn which method comprises the successive steps of feeding the yarn to a tubular treating chamber with the aid of a fluid under pressure to form a wad extending in the direction of the length of the chamber, at least part of the fluid regulating a process parameter via a transmission means in response to an external control signal indicative of the starting point from which the yarn wad extends into the treating chamber and discharging the treated yarn from the chamber.
2. A method as claimed in claim 1 wherein the control is so effected that the starting point of the wad is kept within a predetermined range.
3. A method as claimed in claim 2 wherein the range is a distance of not more than 5 mm on either side of the preset desired starting point of the yarn wad.
4. A method as claimed in claim 3 wherein the distance is about 2.5 mm on either side of the preset desired starting point of the yarn wad.
5. A method as claimed in any one of the preceding claims wherein the fluid under pressure fed to the treating chamber is air or steam.
6. A method as claimed in any one of the preceding claims wherein the preset desired starting point of the wad is at a distance from the entrance of the yarn treating chamber corresponding to not more than one-third of the length of the yarn treating chamber provided with lateral outlets for the fluid under pressure.
7. A method as claimed in any one of the preceding claims wherein the control signal regulates the pressure of an air stream fed to the yarn wad.
8. A method as claimed in claim 7 wherein the air is cooling air.
9. A method as claimed in claim 7 or claim 8 wherein the resulting variations in the air pressure are of the order of 1 bar or not more than 50% of a preset value.
10. A method as claimed in any one of the preceding claims 1 to 6 wherein the control signal regulates via a transmission means the pressure, the amount, the speed and/or the temperature of the fluid fed under pressure to the treating chamber.

11. A method as claimed in any one of claims 1 to 6 wherein the fluid under pressure is sucked off through lateral openings in the yarn treating chamber and the control signal regulates the magnitude of the suction via a transmission means. 5 near the entrance of the yarn treating chamber which device in use, emits a signal which serves to control a process parameter via a transmission means.

12. A method as claimed in any one of the preceding claims wherein the control signal is a pneumatic control signal. 10 22. An apparatus as claimed in claim 21 wherein the sensing device extends from the entrance of the yarn treating chamber over a part of the length thereof. 60

13. A method as claimed in claim 12 wherein the pneumatic control signal is derived from one or more control air streams flowing at right angles to the yarn treating chamber. 15 23. An apparatus as claimed in claim 22 wherein the sensing device extends over the first half of the axial length of the treating chamber. 65

14. A method as claimed in claim 13 wherein the control air streams are directed at the yarn treating chamber over a part of the length thereof. 20 24. An apparatus as claimed in claim 23 wherein the sensing device is provided in the longitudinal direction of the yarn treating chamber with a number of successive outflow openings for control air. 70

15. A method as claimed in claim 14 wherein the control air streams are active over the first half of the axial length of the yarn treating chamber. 25 25. An apparatus as claimed in any one of claims 21 to 24 wherein the wall of the yarn treating chamber is substantially formed by a number of circumferentially spaced fins, at least one of the fins being provided with a cavity adapted to connect to a supply of control air and at its edge facing the yarn treating chamber with a number of outflow openings. 75

16. A method as claimed in claim 15 wherein one or more air streams are also active near to the discharge end of the yarn treating chamber. 30 26. An apparatus as claimed in any one of claims 21 to 25 wherein the sensing device is connected via a transmission means to means for regulating the pressure of the cooling air to be fed to the yarn treating chamber. 80

17. A method as claimed in claim 15 or claim 16 wherein the control air streams are perpendicularly directed at said chamber over practically the entire length of the yarn treating chamber, the control air streams directed at the entrance portion of the yarn treating chamber corresponding to the position of the beginning of the wad of yarn. 35 27. An apparatus as claimed in any one of claims 21 to 25 wherein the sensing device is connected via a transmission means to a system for regulating the pressure, the amount, the speed and/or the temperature of the fluid under pressure which serves to feed the yarn to the treating chamber. 90

18. A method as claimed in claim 17 wherein a number of control air streams measure the position of the beginning of the yarn wad in the entrance portion of the yarn treating chamber and via a transmission means serve to regulate a process parameter. 40 28. An apparatus as claimed in claim 21 wherein the sensing device is constructed to produce a mechanical, electric or visual control signal, or a combination thereof. 95

19. A method as claimed in any one of claims 1 to 10 wherein the control signal is a mechanical, electric or visual control signal or a combination thereof. 45 29. An apparatus as claimed in claim 21 substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings. 100

20. A method as claimed in claim 1 substantially as hereinbefore described with reference to the accompanying drawings. 50 30. A yarn whenever produced by a method as claimed in any one of claims 1 to 20. Agents for the Applicants 105

55 21. An apparatus for carrying out the method claimed in any one of the preceding claims which apparatus comprises a yarn feeding channel coupled to a yarn supply and a conduit for supplying fluid under pressure, the yarn feeding channel ending in a tubular yarn treating chamber provided with lateral openings, and a sensing device positioned near the entrance of the yarn treating chamber which device in use, emits a signal which serves to control a process parameter via a transmission means. 60

22. An apparatus as claimed in claim 21 wherein the sensing device extends from the entrance of the yarn treating chamber over a part of the length thereof. 65

23. An apparatus as claimed in claim 22 wherein the sensing device extends over the first half of the axial length of the treating chamber. 70

24. An apparatus as claimed in claim 23 wherein the sensing device is provided in the longitudinal direction of the yarn treating chamber with a number of successive outflow openings for control air. 75

25. An apparatus as claimed in any one of claims 21 to 24 wherein the wall of the yarn treating chamber is substantially formed by a number of circumferentially spaced fins, at least one of the fins being provided with a cavity adapted to connect to a supply of control air and at its edge facing the yarn treating chamber with a number of outflow openings. 80

26. An apparatus as claimed in any one of claims 21 to 25 wherein the sensing device is connected via a transmission means to means for regulating the pressure of the cooling air to be fed to the yarn treating chamber. 85

27. An apparatus as claimed in any one of claims 21 to 25 wherein the sensing device is connected via a transmission means to a system for regulating the pressure, the amount, the speed and/or the temperature of the fluid under pressure which serves to feed the yarn to the treating chamber. 90

28. An apparatus as claimed in claim 21 wherein the sensing device is constructed to produce a mechanical, electric or visual control signal, or a combination thereof. 95

29. An apparatus as claimed in claim 21 substantially as hereinbefore described with reference to and as illustrated in the accompanying drawings. 100

30. A yarn whenever produced by a method as claimed in any one of claims 1 to 20. Agents for the Applicants 105

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1 SHEET

*This drawing is a reproduction of  
the Original on a reduced scale*

FIG.1

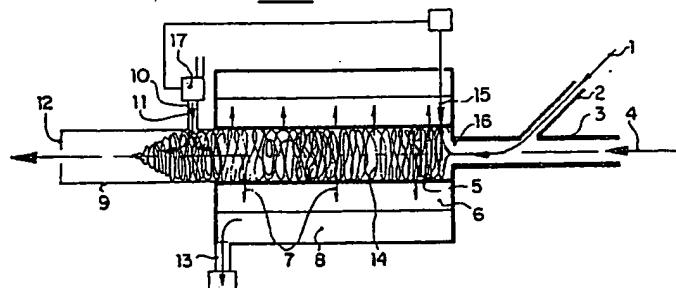


FIG.2

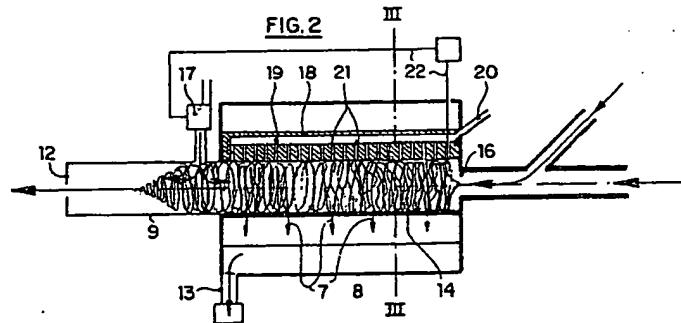


FIG.3

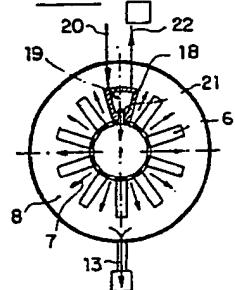


FIG.4

